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H. S. ALLEN.

Blythswood Laboratory, Renfrew, N.B., June 27.

The Teaching of Mathematics.

BEING myself a teacher of mathematics, I have followed with much interest the vigorous crusade against the neglect of suitable scientific and mathematical training conducted by Prof. Perry and others, and am in substantial agreement with Prof. Minchin's remarks in his review in your columns of the series of papers by Prof. Perry on "England's Neglect of Science."

One thing has struck me in connection with school "mathematical" teaching as being a very illogical course of procedure on the part of the dominant "classical cleric" instructors of youth alluded to—namely, the teaching of *arithmetic*. A boy, whether classically or otherwise educated, is considered a dunce if he is not merely not an expert with the multiplication table, but even if he is unacquainted with such things as recurring decimals, square and cube roots, &c., whereas no attempt is generally made to give an insight into *theory*, the results, i.e. the *rules*, are what he is expected to know.

So dissociated to the ordinary mind is the science of arithmetic from mathematics that I can remember a fellow collegian actually remarking, "Mathematicians are bad at arithmetic"! It seems to me, on the other hand, that Euclid is much more out of the line of what we mean by mathematics. In teaching Euclid as a mathematical "subject," and, as some claim, as an introduction to geometry, we are actually raising barriers to the progress of a learner in grasping the meaning and uses of geometry. We insist on the propositions being learned *in all their cases*, insisting on the absolute distinctness of propositions which are merely particular cases of the same proposition, thus tacitly suggesting the existence of some such commandment as "Thou shalt not recognise the Principle of Continuity"—we ignore the infinite and we teach to try and wriggle away from the notion of a "limit." In fact, nearly all that really constitutes mathematics is carefully avoided in teaching of Euclid, whereas I have found, when I have dared once or twice to depart from examination ideals, how true the following remarks of Mr. C. Taylor in his prolegomena to "The Introduction to the Ancient and Modern Geometry of Conics" are. When referring to the work of Boscovich, he says:—"It is remarkable that Boscovich enters upon these abstruse speculations in an elementary treatise for beginners.... The preface to the volume contains an earnest plea for the introduction of the modern ideas into the schools. He had taught the appendix *viva voce* to his own tyros with the happiest results.... demonstrations are put before him (the tyro) in an unsuggestive form which gives no play to his inventive faculty; and thus it comes to pass that of the many students so few turn out genuine geometers..."

I must not encroach further on your valuable space, although many points come to one's mind, such as the exclusion from so-called "higher algebra" papers of the theory of determinants, arithmetic without logarithms, applied mathematics without the calculus, &c., but, in hopes that the attack may be vigorously pushed home, subscribe myself yours sincerely,

Henry Smith School, Hartlepool.

F. L. WARD.

Curious Rain drops.

ON Thursday last, July 11, about 6 p.m., the day having been sultry, the sky became dark and overcast, threatening rain. Only a few scattered drops fell, however (the threatened rain passing off), but these sparse rain-drops drew my attention by their curious appearance on the sill of the window near which I sat.

Each rain-drop had broken up into a number of smaller drops,

which arranged themselves in a circular form around a central one, in the manner here shown :

Perhaps some one of your readers would kindly explain the cause of this, and if it was due to some electrical condition of the atmosphere.

M. S.
Bowdon, Cheshire, July 14.

THE MYCENAEAN QUESTION.¹

THE occasion for the following remarks on that difficult and much disputed subject, the Mycenaean Question, is furnished by the appearance of the timely volume on the "Oldest Civilization of Greece," by Mr. H. R. Hall, of the British Museum, and as public interest in the whole question has been considerably quickened by the important discoveries of Mr. A. J. Evans in Crete, this book, in which certain of the principal results of the Cretan excavations are discussed, will be heartily welcomed by the broad-minded school of classical archæologists in general, and by the student of ancient Oriental civilisations in particular.

It is now some twenty-five years since the spade of Schliemann brought to light the remains of the oldest civilisation of Greece; and as it was soon recognised that these remains belonged to the period of the Bronze Age, it was clear that they must be older than the classical period of Greek culture. The excavations which were made subsequently in several parts of the Greek world by the various investigators who were emulating

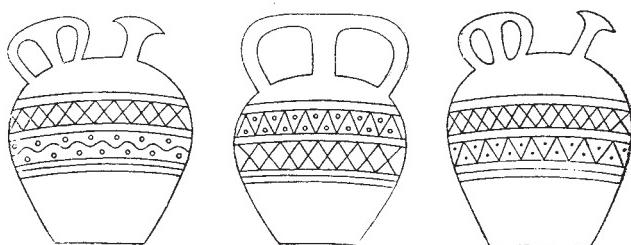


FIG. 1.—Representation of Mycenaean vases; from a fresco in the tomb of King Rameses III. at Thebes, B.C. 1200.

Schliemann's example proved that this Bronze Age culture was not confined to any particular part of Greece, but extended over the whole Hellenic area. Such discoveries compelled classical scholars to abandon many preconceived notions, and they found it necessary to revise entirely their ideas about the origins of Greek civilisation; it is not to be wondered at that many excellent scholars of the "old school" still find it difficult to make their views fall into line with the new order of things in classical archaeology. This is most evident when the dating of Mycenaean antiquities has to be considered, for if the Mycenaean culture, being of the Bronze Age, is necessarily pre-classical, its *floreat* must be assigned to the second millennium before Christ. An important confirmation of this view seems to be supplied by the evidence derived from the excavations which have been made in Egypt in recent years, where a large number of objects, pottery, &c., of Mycenaean origin have been found; and in many cases such objects have been discovered side by side with native Egyptian objects which must belong to the period which lies between B.C. 1500 and B.C. 1000. The discoveries of Mr. A. J. Evans, however, all seem to point to a still earlier date for the first development of

¹ "The Oldest Civilization of Greece: Studies of the Mycenaean Age," By H. R. Hall, M.A., Assistant in the Department of Egyptian and Assyrian Antiquities, British Museum. Pp. xxxiv + 346; with 76 illustrations. (London: D. Nutt, 1901.) Price 15s. net.

Mycenæan culture out of primitive barbarism, and a useful indication of its antiquity is supplied by the discovery, recently announced, of a statue of King Khian of Egypt, in Crete. Now the existence of King Khian was made known to us by numerous scarabs and certain monuments which were found at Tanis in the Delta and Baghdad in Turkey-in-Asia, and it is generally thought that he was a Hyksos king, who reigned about B.C. 1800. Prof. Petrie, judging from the style of the work on Khian's scarabs alone, has assigned this king to a far earlier date, *i.e.* to the period between the sixth and eleventh dynasties, about B.C. 3000; there is, however, no sufficient foundation for this view, and, so far as we know, it is not accepted by the majority of Egyptologists. The discovery of Khian's statue by Mr. A. J. Evans in the Mycenaean Palace of Knossos takes its place naturally in the long series of facts derived from archaeological evidence collected in



FIG. 2.—Egyptian vase imitating Mycenaean form, about B.C. 1350. (British Museum.)

Egypt and Crete, which point with one accord to a date before B.C. 1500 for the beginnings of the Mycenaean period properly so-called.

The first systematic arrangement of the evidence which was derived from the discoveries of Schliemann was embodied in the work "Mykenische Vasen," by Messrs. Furtwängler and Löschcke, to whom the classification of Mycenaean pottery is due, and an anticipation of the conclusions to which Mr. A. J. Evans' discoveries appear to tend in respect of the prominent part which the Cretans took in the early Greek civilisation was essayed by Dr. Milchhoefer, whose "Anfänge der Kunst in Griechenland" appeared about the same time. The position which Mycenaean archaeology had reached about 1890 was well summed up in Dr. Schuchhardt's epitome of Schliemann's works, and in this book we already see the beginnings of an attempt to obtain accu-

rate dates for the periods of the Mycenaean culture by means of conclusions drawn from results supplied by Egyptian excavations. Many of the available data employed by Dr. Schuchhardt and his successors were supplied by the excavations of Prof. Petrie at Kahun and Gurob, and above all at Tell el-Amarna, from which site conclusive evidence of the contemporaneity of Mycenaean culture with the heretic king Amen-hetep IV. and other monarchs of his dynasty can, *pace* Mr. Cecil Torr, be deduced.

But about this time attention began to be drawn to the remains of a pre-Mycenaean period of culture in Greece, and the discoveries of Prof. Dörpfeld at Troy resulted in a definite arrangement of the prehistoric civilisation of Greece in two well-defined periods, viz. the primitive or pre-Mycenaean, and the fully developed or Mycenaean Ages. The arrangement made by Dr. Dörpfeld became, in its turn, the base of a general sketch of Mycenaean archaeology in the Mycenaean Age which was published in 1897 by Prof. Tsountas and Mr. Manatt, a work which, though based on Prof. Tsountas's earlier essay, was thoroughly revised and brought up to date in the light of the most recent research. This book, however, has one cardinal defect, and the evil effects of this defect are far-reaching: Prof. Tsountas, having arrived at certain conclusions, which from the nature of the case must be of a hypothetical character, states them as so many concrete facts instead of giving the reader to understand clearly that they are only his own opinions. Since



FIG. 3.—Bügelkanne of Mycenaean type made in Egypt, B.C. 1350. (British Museum.)

the publication of this book, however, Mycenaean archaeology has entered upon a new phase, owing to the discoveries made by the British School at Athens on the site called Phylakopi, in Melos, and by Mr. A. J. Evans at Kephala, the site of the ancient Knossos in Crete, which have produced a mass of new and highly suggestive material for the archaeologist to work upon; the results obtained from these excavations tend to indicate a comparatively high antiquity, *i.e.* about B.C. 1500, for the period when Mycenaean culture had attained its highest development. A different conclusion, however, seems to have been indicated as the result of the excavations which were carried out at Curium and Enkomi by Dr. A. S. Murray, of the British Museum, and his assistants, Mr. H. B. Walters and Mr. T. L. Myers, for the general evidence derived from the objects which they found in the course of their work shows that Cyprus continued to be included within the circle of Mycenaean culture as late as the ninth and eighth centuries before Christ. This date agrees with that assigned by Mr. A. J. Evans to the late Mycenaean treasure from Aegina which is now in the British Museum.

It has been necessary to make the above somewhat lengthy chronological statement on the Mycenaean question in order that the reader may be able to understand the exact position which Mr. H. R. Hall takes up on this disputed ground of research. He divides his work into eight chapters, which discuss the new chapter of Greek history generally, and the relation between the

archæologist and historian in the elucidation of Mycenæan antiquities ; the generally accepted Mycenæan hypothesis as modified by the latest discoveries ; the questions of date and race ; Mycenæ and the East and Mycenæ and Egypt ; Mycenæ's place in history, including a discussion on the period of the introduction of the metals into Europe ; and the decadence and renascence of Greek culture after the close of the Mycenæan period. The book contains in addition four appendices, seventy-six illustrations, full indices, notes, &c. Many of the facts which are given in Mr. Hall's book are familiar to us from other sources, but he has brought forward from the domain of Egyptology a considerable number which will probably be new to the majority of his readers ; indeed, if we remember rightly, the Mycenæan Question has never before been handled by one whose training has made him familiar with both Greek and Egyptian archæology. His chapter, then, on the connection between Mycenæ and Egypt will be read with much interest, especially his remarks of the identifications of the northern Mycenæan tribes who attacked Egypt between B.C. 1400 and B.C. 1150. He has identified the tribe of the Uashasha with the Axians of Crete, and he has shown the probability that others of the tribes which are mentioned in Egyptian history at this period

Dorians, who, *ex hypothesi*, overthrew the Mycenæan culture in Greece, did not reach Asia until about B.C. 800, and never gained any foothold whatever in Cyprus. Another important point made by Mr. Hall is that, contrary to the usually accepted view, iron was already known to the Egyptians about B.C. 3500, when, as he says (see p. 198), "it appears named and depicted on the monuments in a manner which admits of no possibility of doubt as to its nature." He supports his statements by quotations from a learned article by the Swedish Egyptologist, Prof. Piehl, which appeared in *Ymer* (1888, p. 94 ff.), from which it may be safely concluded that the Egyptians were acquainted with the use of iron some 2500 years before it came into general use in Europe. We notice that the passages which Mr. Hall quotes from Egyptian texts are translated by him especially for the purposes of this book, and he weighs with discretion the evidence which many would derive from the cuneiform and from the so-called "Hittite" inscriptions for the elucidation of the origins of Mycenæan culture. It is interesting to note that he believes it possible that the system of writing which was in use among the Cretans may have been derived from the Egyptian hieratic, and he points out some probable instances of the similarity between the two scripts ; but, contrary to the opinion expressed by Mr. A. J. Evans,

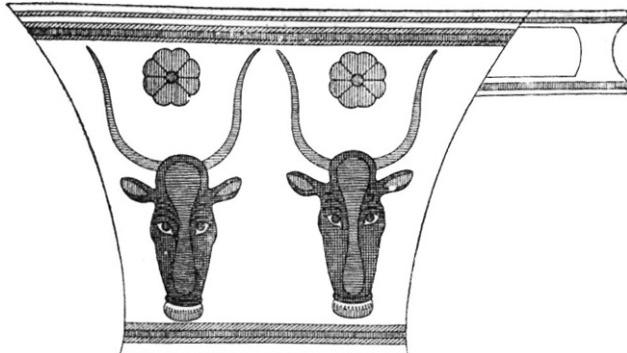


FIG. 4.—Representation of a Mycenæan metal vase from the tomb of Rekh-ma-Rā at Thebes, B.C. 1550.



FIG. 5.—Representation of a Mycenæan metal vase from the tomb of Rekh-ma-Rā at Thebes, B.C. 1550.

were of Cretan origin, including the Pulesatha, or Philistines.

It has been noticed that many of the names of these tribes ended in "sha" or "na," and Mr. Hall has, with apparently very good grounds, identified these terminations with the common nominal suffixes "azi" and "ñna" which are found in the Lycian language and, seemingly, also in other cognate speeches of Asia Minor. Mr. Hall seems also to have devoted his energies to the solution of the difficult problem of dating the early antiquities of Greece, and, so far as we understand him, he takes in this respect a position midway between those who hold that the latest date possible in Mycenæan archæology is B.C. 1100 and those who hold, with Dr. A. S. Murray, that this date is more likely to be the *earliest* which can be assigned to Mycenæan antiquities, i.e. he believes that in Greece proper and in Crete the Mycenæan culture began at a very early period—which, however, he does not define exactly—and had already reached its highest pitch of development about B.C. 1500, when its chief seat was in Crete, and when it was extending its influence to Egypt and Asia Minor. He considers that the discrepancy between the two extreme views can be reconciled on the theory that in Greece proper the Mycenæan age came to an end about B.C. 1000, but continued to exist in Asia Minor until about B.C. 800, and in Cyprus until a century later.

This view is perhaps confirmed by the fact that the

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he thinks that the writing is to be read from right to left, because the figures of men, birds, &c., which occur in it invariably face to the right, and should, on the analogy of Egyptian, face the beginning of the line (see p. 141). Still, it must not be forgotten that, chiefly owing to geographical difficulties, there cannot have been much direct communication between Crete and Egypt across the open sea in the Mycenæan period, and the connection between the two countries must have been carried out *via* Cyprus and the coast of Palestine ; and it is a fact that the Cretan and other northern marauders who attacked Egypt in the reigns of Menephthah and Rameses III. made their way to Egypt by this route.

There are many other points of interest in the book to which we should like to draw attention, but our space is exhausted. The Mycenæan question is a difficult one, and one which, in our opinion, will not be settled for some years to come ; the evidence which will bring about this result is accumulating, but there is not enough of it available yet. The most serious phase of the question as it now presents itself is the discrepancy between the dates assigned by experts for the beginning and end of the period of Mycenæan culture proper. Mr. Hall does not claim, if we understand him aright, to have settled this difficulty, but there is no doubt that he has collected a number of facts which will one day form valuable elements in the solution of the problem, and he has set forth the Egyptian aspect of the Mycenæan question in a clearer form than any of his predecessors. His volume contains an excellent summary of the work

already done, and will give the reader a capital idea of the position of the workers in the Mycenaean field ; it will also enable him to take an intelligent interest in the labours of future workers and to appreciate the developments of a most fascinating line of research.

THE SOUTH EASTERN AGRICULTURAL COLLEGE AT WYE.

THE new block of buildings just completed at the South Eastern Agricultural College at Wye, Kent, is to be opened by the Right Hon. R. W. Hanbury, president of the Board of Agriculture, as we go to press this week. As the College has been constituted a school of the University of London in Agriculture, it may be of interest to give a short account of this institution—one of the most advanced examples of the development of agri-

rangle, with lecture rooms, &c., on the ground floor and students' living rooms on the first floor ; the chemical laboratories occupy a further wing. There are two lecture rooms, one a theatre with raised seats accommodating 150 people ; the drawing office provides working space for twenty-four students in such subjects as surveying, building construction and farm engineering. On the biological side there is a laboratory with working space for thirty students, furnished with Swift's histological microscopes ; two smaller laboratories for the professors of botany and economic entomology, and a museum, of which the chief features at present are a collection illustrating the insect pests attacking fruit and hops, specimens illustrating the forestry course, pathological specimens in connection with farm animals, typical cereals, soils, &c.

The chemical laboratories consist of a general students'

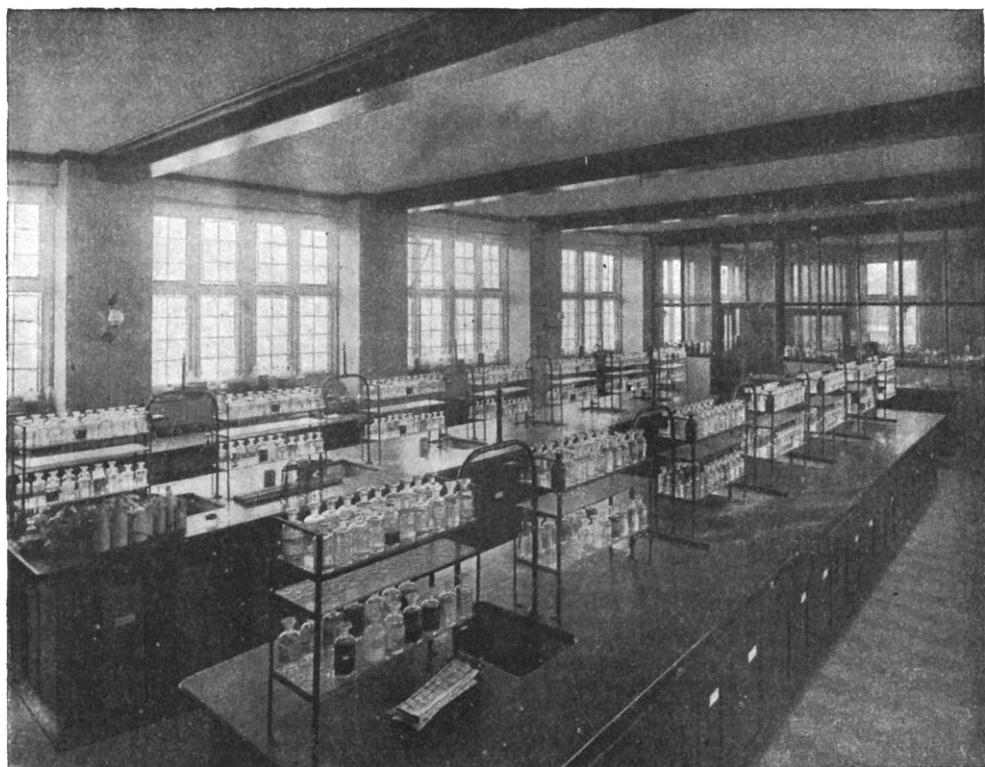


FIG. 1.—Chemical Laboratory of the South Eastern Agricultural College.

cultural education under the administration of "the whisky money" by county councils.

The College began work in 1895, and is managed under a scheme of the Charity Commissioners by a governing body appointed by the county councils of Kent and Surrey, together with representatives of the Universities of Oxford, Cambridge and London, the Royal and the Bath and West Agricultural Societies. The buildings, which are situated at Wye, a little village on the South-Eastern line between Ashford and Canterbury, consist of a nucleus built about 1470, an ancient collegiate foundation due to the Cardinal Archbishop Kempe, with successive additions made in 1894 and the current year.

The old buildings form a small quadrangle with brick cloisters and include a fine and lofty hall, the refectory of the original College now restored to its original purpose, and a beautiful oak panelled room, which is used as the library. The later additions form a second quad-

laboratory, measuring about 45 by 30 feet, lighted on both of the longer sides of the room ; it is fitted with two double benches running longitudinally, reagent bottles being carried on glass shelves down the middle of the tables. The two benches give working room for thirty students, and other benches in the window recesses are provided for special work ; water and gas are laid on to all the tables, and there are two fume chambers within and one outside the laboratory. Separated from the main laboratory by a glazed partition is the balance room and the larger of the analytical laboratories ; adjoining this comes a smaller room reserved for gas analysis, titrations, &c., that require an acid or ammonia free atmosphere, and next to this comes a room for the furnaces and for ether extractions and other operations involving the use of inflammable liquids ; in one corner of this room a drying chamber has been built.

The College farms about 250 acres of land adjoining